

Report Number 68-3346.11ja-38

FACILITY FORM 602

N 68-29984	(ACCESSION NUMBER)	(THRU)
4	(PAGES)	0
CR-92198	(NASA CR OR TMX OR AD NUMBER)	05
		(CATEGORY)

MEASUREMENTS REPORT: THERMAL PROPERTY  
MEASUREMENTS OF MANNED SPACECRAFT  
CENTER SPACESUIT MATERIALS

Contract Number NAS 9-3670

TRW Sales Number 4085-002

May 1968

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## I. INTRODUCTION

Near-normal emittance properties of the NASA Manned Spacecraft Center face shield (S/N OA-7-2-1) and a test chip (S/N OA-7-2-1-2) have been measured by TRW Thermophysics Section laboratory personnel. These measurements were taken in response to a verbal request by J. Poradek of the NASA Manned Spacecraft Center. The face shield and test chip measured were delivered to the Thermophysics Section laboratory by W. Cannon of the LTV Aerospace Corporation.

## II. METHOD OF MEASUREMENT

Near-normal emittance was determined from reflectance data measured with a Gier Dunkle Infrared Reflectometer (Model DB 100). This instrument is similar to that described by Nelson, et al.<sup>1</sup> Normal emittance ( $\epsilon_Q$ ) was calculated from the expression:

$$\epsilon_Q = 1 - \rho$$

where

$\epsilon_Q$  = normal emittance measured with the Quick Emittance Device

and

$\rho$  = reflectance as read directly from the reflectometer scale.

It should be pointed out that these inspection measurements are of limited absolute accuracy (generally  $\pm 0.05$ ), but good relative accuracy (generally  $\pm 0.02$ ). Therefore, these measurements, when used in conjunction with accurate absolute methods (e.g., calorimetric methods) are extremely useful for scanning large quantities of similar materials. Care should be exercised when comparing different classes of materials based on the  $\epsilon_Q$  measurement only, since the absolute accuracy of the instrument is a strong function of material class; i.e., metals, opaque dielectrics, and semi-transparent materials are all subject to errors of differing magnitude. A complete discussion of the instrument is presented in Reference 1.

### III. MEASUREMENT RESULTS

Emittance measurements were taken on the external surface of the face shield at the positions shown in Figure 1. Test chip positions measured are shown in Figure 2.

SAMPLE MEASURED	POSITION NUMBER	NORMAL EMITTANCE
Face Shield (OA-7-2-1)	1	0.11 <sub>8</sub> *
	2	.14 <sub>7</sub>
	3	.32 <sub>5</sub>
	4	.03 <sub>6</sub> (Bull's-eye)
	5	.28 <sub>5</sub>
	6	0.15 <sub>7</sub>
	7	.15 <sub>8</sub>
	8	.11 <sub>8</sub>
	9	.11 <sub>5</sub>
	10	.17 <sub>8</sub>
	11	0.12 <sub>5</sub>
	12	.12 <sub>0</sub>
	13	.19 <sub>5</sub>
Test Chip (OA-7-2-1-2)	1	0.19 <sub>4</sub>
	2	.20 <sub>9</sub>
	3	.14 <sub>7</sub>

\* Accuracy of the measurement does not justify a third significant figure. It is shown here, depressed, merely to indicate data trends.

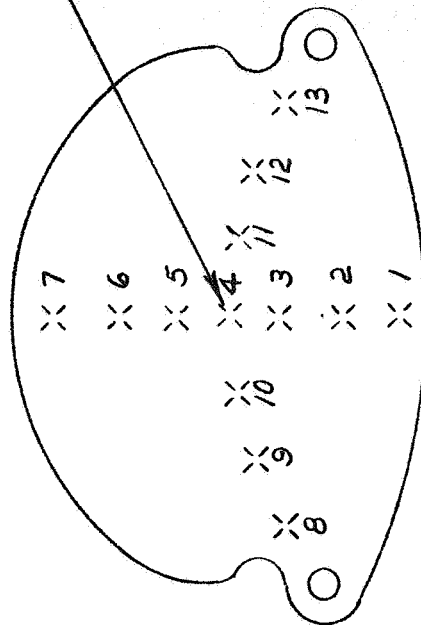
### IV. REFERENCES

1. Nelson, K. E., Luedke, E. E., and Bevans, J. T., "A Device for the Rapid Measurement of Total Emittance," Journal of Spacecraft and Rockets, pp. 758-760 (May 1966).

SK

CHG LTR

BULL'S-EYE



TOP

LEFT EAR  
PIVOT

ORIGINATOR	DATE	TITLE	ENGINEERING SKETCH
		Figure 1	TRW SYSTEMS
			SK
MJO			SHEET OF

SK

CHG LTR

S-I-S-T-AO

X X X  
3 2 1

TEST CHIP VIEWED FROM THE  
COATED SIDE

ORIGINATOR	DATE	TITLE	ENGINEERING SKETCH
			TRW SYSTEMS
			SK
MJO		Figure 2	SHEET OF